Chapter 6

Marine Habitat and Fisheries

6.1 Primary Issues

The primary issues analyzed in this chapter include:

- Would shading from barges at the dock adversely affect eelgrass or other marine biological communities?
- Would accidental spillage of sand and gravel during barge loading adversely affect marine life under or near the dock and barges?
- What would be the potential for petroleum spills from increased marine equipment activity?
- Would an increase in turbidity and deposition of fine sediment from mining and barge traffic propeller wash affect marine organisms?
- Would removing a portion of the bluff during mining change the deposition/erosion dynamics of the beach?
- What effect would the project have on geoduck clam harvest by the Puyallup Tribe?
- Would the noise and vibration from pile driving or barge loading affect salmon and other marine animals, including whales?
- Would dock repairs alter salmon habitat or other marine habitats?

6.2 Affected Environment

The physical and biological characteristics of the marine environment adjacent to the project site are fairly typical of Puget Sound beaches. For a comprehensive review of shoreline life in Puget Sound, see Kozloff (1983). Biological resources of particular concern at the site are eelgrass, bull kelp, herring, surf smelt, sand lance, geoduck, sea cucumbers, and Puget Sound chinook salmon (a species federally listed as threatened).

The following sections describe the physical and biological conditions of the site.

6.2.1 Physical Components

Depth, slope, substrate (bottom material), current, and sediment deposition/erosion are key components of the physical condition of the shoreline, and these components directly correspond to the types of plants and animals present.

The shoreline can be divided into three physical zones (Figure 6-1). The most shoreward is the intertidal area, the portion of the shoreline that is periodically inundated with the movement of the tides. Most of the substrate in the intertidal zone is sandy, with occasional bands of cobble (stones 2.5 to 10 inches in diameter) running parallel to the beach.

The second physical zone is the area between mean lower low water elevation (MLLW) and about -30 feet MLLW, referred to here as the nearshore subtidal zone. This zone is dominated by sand and silt substrate. The bottom gradually slopes from the shoreline to the seaward edge of the dock, at which point the bottom drops off steeply at about -17 feet MLLW. In the immediate vicinity of the end of the dock, it appears that sand and gravel spilled during previous operations have been deposited and the drop-off occurs at about -20 feet MLLW.

The third physical zone includes the deeper, more steeply sloping areas with tidal elevations below -30 feet MLLW, referred to here as offshore habitat. Offshore areas contain a mix of coarse and silty sands.

The primary area of interest for this analysis is the nearshore subtidal of approximately -22 feet MLLW or less (Figure 6-1). This is within the depth zone found to support eelgrass in Puget Sound (Phillips 1984). Eelgrass is highly valued for its use by spawning herring, Dungeness crabs, juvenile salmon (which also use the intertidal zone), and other marine animals.

As Figure 6-1 shows, water depths seaward of the dock are mostly deeper than -22 feet MLLW. This is important because eelgrass and associated communities typically do not occur at this depth or greater.

Two areas seaward of the dock are less than 22 feet deep: (1) the area directly under the end of the conveyor, and (2) an area 360 feet north of the conveyor.

Directly beneath the end of the conveyor is a deposit of sand and gravel, presumably due to an accidental spill of gravel during loading operations over 20 years ago. The top of the mound is slightly above the substrate inshore of this point.

The second shallow extension of the inshore bench, about 360 feet north of the conveyor, appears to be natural. The substrate here contains coarser sand than that found inshore, but does not contain cobble as found under the end of the conveyor. Eelgrass grows in this area.

Human-made features are present as well and provide habitat for species that would otherwise be absent from the area, thereby increasing the overall diversity of the shoreline. Human-made features include the dock, a sunken pleasure boat, and two sunken wooden barges.

Table 6-1 summarizes the physical components of the marine habitat associated with the project site, as well as associated algae, plants, and animals typical of the area.

6.2.2 Biological Components

6.2.2.1 Eelgrass and Kelp

As shown in Figures 6-1 and 6-2, eelgrass grows at numerous spots along the shoreline, including two small spots (less than 25 square feet) directly beneath the pier. The Puget Sound Environmental Atlas (Evans-Hamilton and D.R. Systems 1987, PSEP 1992) shows eelgrass (*Zostera* spp.) beds present along most of the southeastern shoreline of Maury Island, including at the project site. Both eelgrass and kelp provide important habitat for many fish and wildlife in Puget Sound, including spawning habitat for Pacific herring. Pacific herring are a crucial link in the Puget Sound food web as they are the primary food for salmon and many other fish. Bull kelp (*Nereocystis leutkeana*) is not shown at the project site, but the atlas indicates it is present northeast of the project site toward Point Robinson.

Based on habitat, eelgrass could occur anywhere down to a depth of –22 feet MLLW. To verify this, as described in Section 6.4, Mitigation Measures, surveys will be completed between June and

October, when the extent of eelgrass is at its maximum (results will be presented in the Final EIS). The eelgrass coverage shown in Figure 6-2 indicates the extent of eelgrass coverage in January, which may or may not underestimate the maximum extent of eelgrass coverage. However, this assessment is based on the assumption that all potential areas of eelgrass (all areas up to -22 feet MLLW) contain eelgrass.

6.2.2.2 Geoducks

Geoduck (*Panope abrupta*) clam beds are found along the entire southeastern shoreline of Maury Island, including the project site (Sizemore et al. 1998). Geoduck harvest is an economically important fishery in Puget Sound. These geoducks are part of the 149-acre Maury Island geoduck tract (a large congregation of geoducks delineated by the Washington Department of Fish and Wildlife), with clams at an average density of 0.22 clams per square foot (Sizemore et al. 1998). Most of the clams are within 200 yards from shore, and are subject to harvest restrictions in January and February due to spawning herring.

The Washington Department of Health recently certified this geoduck bed safe to harvest, and the Puyallup Tribe has obtained state permission to commercially harvest clams from this bed, and plans to harvest during the next few years. Puyallup clam divers work four days per week between 8 a.m. and 4 p.m. (Winfree pers. comm.). The Washington Department of Fish and Wildlife allows an annual harvest of up to 2 percent of the available geoduck biomass, which is thought to be a sustainable yield in most locations (Bradbury et al. 1997).

6.2.2.3 Sea Cucumbers

Like geoducks, sea cucumbers are found in the deeper subtidal areas. The project site is listed as supporting sea cucumbers in the Puget Sound Environmental Atlas (PSEP 1992). Sea cucumbers (*Parastichopus californicus*) are collected by commercial divers in Puget Sound. The steep slope of the bottom probably limits the distribution of accessible sea cucumbers to a relatively narrow belt.

6.2.2.4 Herring

Herring, surf smelt, and sand lance are important forage fish for other fish such as salmon, and constitute an important baitfish fishery in Puget Sound. They are among the species the Washington Department of Fish and Wildlife is charged with protecting, along with their habitats, in the Hydraulic Code Rules (WAC 220-110).

Pacific herring (*Clupea harengus pallasi*) spawning areas have been identified in the vicinity of the Lone Star Northwest dock on Maury Island (WDFW 1995), but not at the site itself. These spawning areas are shown to start at the point comprising the Sandy Shores housing complex about 0.5 mile southwest of the Lone Star dock and continue southwest into all of Quartermaster Harbor. These herring are considered to be part of the Quartermaster Harbor stock, which spawn from January to mid-April. Eelgrass is a preferred substrate for herring spawn deposition, along with marine algae and sometimes other materials such as pilings and docks (Hart 1973). It is likely that herring spawn in eelgrass in the nearshore subtidal zone at the project site due to the proximity of known spawning areas and the presence of eelgrass at the site.

6.2.2.5 Surf Smelt

Although no surf smelt (*Hypomesus pretiosus*) spawning beaches have been identified at the site, they are noted to the southwest of the Lone Star Northwest dock on the southeast shoreline of Maury Island between the point at Sandy Shores and Piner Point (Penttila 1995a). Spawning beaches have also been identified northeast of the project site at Point Robinson. Surf smelt spawn on coarse sand/pea gravel substrate in upper intertidal areas. Due to the near proximity of surf smelt spawning beaches, it is likely surf smelt also spawn in the intertidal zone near the project site when appropriate substrate is available. This surf smelt stock spawns from October through February of each year.

6.2.2.6 Sand Lance

Sand lance (*Ammonites hexapterus*) spawning areas have been identified in the same areas on Maury Island as mentioned above for surf smelt (Penttila 1995b); thus it is also possible that sand lance spawning areas could be present in the intertidal zone at the project site when appropriate substrate is available. Sand lance are not known to currently spawn on the project site. Sand lance spawn in the upper intertidal area from November 1 through February 15, persisting until late March in some areas (Penttila 1995b).

6.2.2.7 Salmon

Chinook, coho, pink, and chum salmon, steelhead, and sea-run cutthroat trout all use the intertidal environment of southern Puget Sound during the juvenile life stage. Juvenile salmon forage for tiny crustaceans and other animals among the substrate, algae, and eelgrass of the intertidal zone. Larger salmon may also be found in deeper offshore habitat. Juvenile salmon are assumed to use the intertidal zone around the existing dock, and larger salmon use the offshore habitat. Juvenile salmon are present primarily during late spring and early summer. Older salmon may be present offshore all year.

6.2.3 Other Considerations of the Marine Environment

6.2.3.1 Recreational Fisheries

With the exception of geoduck beds, as described earlier, no recreational shellfish beaches or commercial shellfish beds are located on the southeast shoreline of Maury Island (Washington State Department of Health 1996). However, other less economically important species of fish and invertebrates are likely found along the shoreline of the project site.

Some recreational catch of chinook salmon probably occurs offshore from the project site.

6.3 Impacts

6.3.1 Would shading from barges at the dock adversely affect eelgrass or other marine biological communities?

6.3.1.1 Proposed Action

Eelgrass is known to be adversely affected by shading (Fresh et al. 1995), and public scoping comments for this EIS identified shading from barges on eelgrass beds as a concern. In Puget Sound, the lower depth limit of eelgrass distribution appears to be limited by winter light penetration (Phillips 1984). Kelp is also subject to adverse effects of shading. Shading can also lead to lower productivity of invertebrates that feed on eelgrass or macroalgae (kelp and other seaweed). In another Puget Sound location, turbulence from Washington State Ferry vessel traffic has been identified as shading eelgrass beds, possibly causing a reduction in eelgrass coverage (Thom et al. 1995).

However, shade generated from the presence of barges at the Maury Island site is not expected to significantly reduce eelgrass or kelp beds because:

- No eelgrass is present and habitat is not suitable where shading would occur. Except for a small area near the northern edge of the pilings, the barge loading area waterward of the pilings is deeper than the -22 feet MLLW limit of eelgrass growth (Phillips 1984). Eelgrass grows in the shallow areas between the pilings and shoreline, and these areas would not receive increased shading. No kelp is present within areas that would be shaded.

- Shading may alter invertebrate populations or other marine life on the dock, but this impact would be minor, since the extent of alteration would cover a relatively small area and only common species would be potentially affected.

- During barge loading operations, tugboats would typically be aligned to the barge with the propeller wash oriented parallel to or away from the shore. Any decrease in light associated with turbulence and bubbles in the wash plume would be directed parallel to shore at a depth where eelgrass does not grow. Based on these factors, propeller wash would not reduce eelgrass coverage.

6.3.1.2 Alternative 1

Shading effects from Alternative 1 would be essentially the same as under the Proposed Action. Barges could be tied up at the dock during more daylight hours, since night loading would not occur. However, as discussed under the Proposed Action, this would not shade eelgrass or kelp beds.

6.3.1.3 Alternative 2

Shading effects from Alternative 2 would be essentially the same as under the Proposed Action. Barges would be loaded only during daylight hours, but fewer average hours per day would be required at this level of output than under the Proposed Action. As discussed under the Proposed Action, eelgrass and kelp beds would not be shaded.

6.3.1.4 No-Action

Under the No-Action Alternative, as defined in Chapter 2, there would be no barge activity or modifications to the dock and no increase in shading of the marine environment.

6.3.2 Would accidental spillage of sand and gravel during barge loading adversely affect marine life under or near the dock and barges?

6.3.2.1 Proposed Action

Geoducks, clams, eelgrass, kelp, and other marine life under or near the dock and barges could be adversely affected in the event of accidental spillage via direct burying or by increased turbidity in the water. If surf smelt or sand lance spawning occurs at the site, increased turbidity could lead to greater egg mortality or the avoidance of affected beach areas by spawning adults (Morgan and Levings 1989, Wildish and Power 1985).

However, no significant impacts from accidental spillage of sand and gravel are anticipated because:

- Effective mitigation to reduce spillage would be applied. The applicant has proposed to install a spill tray below the conveyor belt from the beach out to the discharge end. The operator would check and maintain the tray on a regular schedule. (See also Section 6.4, Mitigation Measures.)

- Impacts would be low where minor spillage is expected. Minor spillage is expected where the conveyer belt would dump material onto the barge and along the sides of the barge. This area (right at the bathymetry break) does not contain eelgrass, kelp beds, or other primary features of concern, and gravel has already been deposited in this area.

- The operator will have a high incentive not to spill because of loss of revenue, interference with barge docking, and costs of environmental restoration.

- An automatic conveyor shutoff switch would be used to prevent the conveyor from running unless a barge is docked.

6.3.2.2 Alternative 1

The potential for accidental sand and gravel spillage would be somewhat less than under the Proposed Action, since less material would be loaded with the conveyor system.

6.3.2.3 Alternative 2

The potential for accidental sand and gravel spillage would be somewhat less than under the Proposed Action or under Alternative 1, since less material would be loaded with the conveyor system.

6.3.2.4 No-Action

Under the No-Action Alternative, no sand and gravel would be loaded using the conveyor system and there would be no risk of accidental sand and gravel spillage.

6.3.3 What would be the potential for petroleum spills from increased marine equipment activity?

6.3.3.1 Proposed Action

The possibility of accidental spills of petroleum products due to the proposal is minor because:

- No vessel refueling would take place at the project site, reducing the risk of petroleum spills.
- All vessels would operate in compliance with Coast Guard regulations to limit the potential for petroleum spills.
- Barges would be hauling sand and gravel, not petroleum products.
- All vessels would operate with spill containment equipment aboard.

6.3.3.2 Alternative 1

The potential risk of accidental petroleum spills under Alternative 1 would be similar but less than that under the Proposed Action because fewer barge trips would likely occur each day.

6.3.3.3 Alternative 2

The potential risk of accidental petroleum spills under Alternative 2 would be similar but less than that under the Proposed Action or Alternative 1 because fewer barge trips would likely occur each day.

6.3.3.4 No-Action

Under the No-Action Alternative, as defined in Chapter 2, there would be no barge loading and therefore no risk of petroleum spills from marine traffic due to the project.

6.3.4 Would an increase in turbidity and deposition of fine sediment from mining and barge traffic propeller wash affect marine organisms?

6.3.4.1 Proposed Action

Mining Activity. Mining activity is not expected to cause a reduction in marine water quality because:

- Surface water from the mining operation would infiltrate to the underlying aquifer via the proposed retention/infiltration pond. No washing of excavated material would occur onsite. Therefore, sediments in surface water generated by mining should not reach Puget Sound.

- The potential for impacts to groundwater quality from mining operations is evaluated in Chapter 4, Geology/Hydrogeology, and Chapter 10, Environmental Health and Safety. Based on the analysis presented in these chapters, significant impacts to groundwater quality from onsite mining activities would not occur.

Marine Sediment Disturbance. Barge and tug traffic is not likely to result in disturbances to the bottom sediments that would result in temporary increases in turbidity or locally depressed dissolved oxygen levels because:

- Tug operations would be conducted in deeper waters where propeller wash would be largely dissipated by the time it hits bottom. The bottom depth at the dock is generally greater than 30 feet (i.e., the depth below the end of the dock is 29 to 41 feet deep at MLLW, and deeper at higher tide).

- Propeller wash would be directed either parallel to or away from the shoreline.

- Sensitive habitat is close to the shoreline and away from the proposed tug traffic propeller wash.

- Currents continuously flush the southeast side of Maury Island (McGary and Lincoln 1977), and would prevent disturbed sediment from causing a decrease in dissolved oxygen.

6.3.4.2 Alternative 1

The potential for sediment disturbance effects from Alternative 1 would be somewhat less than under the Proposed Action, since this alternative would require fewer barge loads per day.

6.3.4.3 Alternative 2

The potential for sediment disturbance effects from Alternative 2 would be somewhat less than under the Proposed Action or Alternative 1, since this alternative would require fewer barge loads daily than either of the other action alternatives.

6.3.4.4 No-Action

Under the No-Action Alternative, there would be no potential for marine sediment disturbance due to the project since no barge loading or shipping would take place.

6.3.5 Would removing a portion of the bluff during mining change the deposition/erosion dynamics of the beach?

6.3.5.1 Proposed Action

Approximately the upper one-half of the height of the bluff along the southeastern side of the site would be removed by mining activities. Beaches are maintained through a natural equilibrium between deposition and erosion of rock, sand, and sediment. Therefore, changes in material available for deposition through bluff erosion could result in changes in the characteristics of the beach below.

However, the existing bluff is well vegetated in the vicinity of the project site, and contributes much less sediment to the beach than an unvegetated bluff would. The applicant would leave a 200-foot vegetated buffer from the beach inland. This buffer would continue to provide protection against erosion and would be expected to maintain approximately the existing conditions of sediment input from the bluff to the beach. Thus, the erosion and deposition dynamics of the beach are not expected to change with implementation of this project.

6.3.5.2 Alternative 1

The effects of removing a portion of the bluff would be the same under Alternative 1 as under the Proposed Action, except that the change in topography would presumably take place over a longer time since mining would occur at a slower rate.

6.3.5.3 Alternative 2

The effects of removing a portion of the bluff would be the same under Alternative 2 as under the Proposed Action. The change in topography would take place over a longer period than under either the Proposed Action or Alternative 1.

6.3.5.4 No-Action

Under the No-Action Alternative, mining would continue at the site, but at very low levels. Changes in the topography would occur slowly over many years. No changes in beach erosion/deposition dynamics would be expected.

6.3.6 What effect would the project have on geoduck clam harvest by the Puyallup Tribe?

6.3.6.1 Proposed Action

During barge loading operations, it would be unsafe for geoduck divers to work in the vicinity of the end of, or approaches to, the dock. Although the Proposed Action calls for loading to occur 24 hours, 7 days a week, breaks in loading would occur between filling orders for sand and gravel. Assuming an agreement regarding access to the area at the end of the dock can be reached prior to initiation of the project, geoduck divers should be able to harvest this area each year. Otherwise, some compensation might be required for taking this area out of harvest production.

6.3.6.2 Alternative 1

The effect of Alternative 1 on geoduck harvest would be the same as under the Proposed Action, except that it might be more difficult to schedule access for geoduck divers, since barge loading could only occur during more limited hours.

6.3.6.3 Alternative 2

The effect of Alternative 2 on geoduck harvest would be the same as under Alternative 1.

6.3.6.4 No-Action

Under the No-Action Alternative, as defined in Chapter 2, no barge loading would occur. Therefore there would be no reduction in access to the site by geoduck divers.

6.3.7 Would the noise and vibration from pile driving or barge loading affect salmon and other marine animals, including whales?

6.3.7.1 Proposed Action

Pile driving and barge loading would create noise and vibrations underwater. For this particular project, some citizens have voiced concerns that the noise would harm juvenile salmon that may use the shoreline area and would alter the behavior of marine mammals.

Adult salmon would easily be able to avoid the immediate vessel traffic and propeller wash in the offshore subtidal zone and would not, therefore, be affected by the Proposed Action.

For salmon, the primary concern is related to juvenile migration, feeding, and rearing, as identified in WAC 220-110-271. Based on the known biology of salmon, the key concern for juvenile salmon are projects that occur near the mouths of rivers. During migration to salt water from fresh water (which occurs in the spring), juvenile salmon often linger close to the mouths of rivers where fresh water is still present. As they arrive in these areas, they may stay near the surface and in shallow areas along the shore, where a “lens” of fresh water is present. They will stay within this freshwater lens as they slowly adjust to saltwater conditions.

Because juvenile salmon tend to congregate at the mouths of rivers, and because their movements are restricted due to their limited adaptability to saltwater, construction work near the mouths of major rivers poses the greatest potential risk to juvenile salmon.

At the Maury Island site, this use of a freshwater lens is not an issue. Since no river is nearby, the waters near the dock do not contain significant freshwater layers nor do they receive juvenile salmon fresh from the river, but rather schools of fully adapted marine-stage juvenile salmon. Therefore, the most serious concern for migrating juvenile salmon (impacts during the relatively vulnerable time when fish are transitioning from a freshwater to a saltwater metabolism) is not an issue at the Maury Island site.

Once migrating juvenile salmon adjust to the marine environment near the mouths of rivers, they begin to disperse and head toward sea, where they will spend the next several years before returning to spawn. As they first leave the estuary areas, these fish stay very near the shoreline. Biologists speculate that they do this to avoid predators. As the fish become larger (typically by midsummer), they become less vulnerable to predation and venture out into deeper waters.

Therefore, essentially all shallow shoreline areas are potential juvenile salmon rearing and migration habitat during spring and early summer. It follows that juvenile salmon occur near and around the existing dock and, in particular, close to low-tide level where some eelgrass beds are present. The shoreline area is part of the overall shoreline habitat used by juvenile salmon throughout Puget Sound. The site is not particularly unique in terms of habitat for salmon.

Since juvenile salmon are expected to occur near the project site, repair, maintenance, and operation of the dock and associated tugs and barges under the Proposed Action and Alternatives 1 and 2 could cause juvenile salmon to disperse. This reaction could conceivably increase their risk of falling prey to larger fish or birds. Dock repair and construction is known to have some effects on juvenile salmon, and, intuitively, it makes sense that construction activity would cause some fish to leave the area (especially pile driving).

However, in a study conducted for the U.S. Navy Home Port at the mouth of the Snohomish River (a known juvenile salmon migration route), the actual effects of pile driving on juvenile salmon were observed to be relatively minor (Anderson 1990).

While juvenile salmon occurred in lower numbers near active pile driving operations, the study found that the decrease was "subtle" and that juvenile salmon were often observed "milling around the pile driving rigs during active pile driving." As is the case with most animals, salmon are expected to tolerate certain constant noises and disturbances. Noise and vibration from shoreline activities, such as those that would occur at the project site, are not significant factors contributing to the decline of salmon populations (in contrast to dams, harvest, spawning habitat destruction).

Based on these considerations, the overall magnitude of the effects on salmon from barge loading and dock repairs at the Maury Island site would be relatively minor. The effects could be reduced even lower by restricting construction activities as recommended by WAC 220-110-271 (no construction between March 15 and June 14 of any given year). This mitigation measure is required through WAC 220-110-271.

For marine mammals, such as whales, seals, and sealions, construction and activity at the project site would cause negligible effects. The basis for this conclusion is related to the context of the Puget Sound environment. Shipping traffic and port activities are a commonplace reality for the marine mammals that inhabit the area. For example, seals and sealions are common at the Ballard Locks and Shilshole Bay, where ship traffic and noise and human disturbance levels are very high. In addition, the project site is not located at any major feeding ground, congregation point, breeding area, or migration route for marine mammals.

The most likely effect of the project on marine mammals would be the avoidance of the area by harbor seals during times when barges are being loaded. Harbor seals tend to avoid areas of high human disturbance. Nevertheless, harbor seals have been observed in relatively high human use areas, including Elliott Bay.

Killer whales are the most commonly occurring resident whale species, although they do not occur regularly off the shores of Maury Island. They are not expected to be affected by the project since they have been shown to be adapted to the presence of humans and related noises and activities.

Other species of whale, including gray and minke, occur sporadically in Puget Sound and may travel in the vicinity of Maury Island. The Proposed Action is not expected to significantly alter such use because of the infrequency of that use, the demonstrated tolerance to disturbance and, as mentioned previously, the overall environmental context of Puget Sound. In spring 1999, a gray whale spent two days along the Seattle waterfront, where intense industrial and shipping activities occur. The whale was apparently unaffected by the activities.

6.3.7.2 Alternatives 1 and 2

For the same reasons outlined above, Alternatives 1 and 2 would have no significant effect on salmon, marine mammals, or their habitat.

6.3.7.3 No-Action

Since no activities would occur along the shoreline, the No-Action Alternative would have no effect on salmon, marine mammals, or their habitat.

6.3.8 Would dock repairs alter salmon habitat or other marine habitats?

6.3.8.1 Proposed Action

Installation of approximately 30 new dock pilings and “fresh heading” 10 existing pilings in order to prepare the dock for use would result in some sediment disturbance and a temporary increase in turbidity. Increased turbidity in the intertidal and nearshore subtidal zones can interfere with the ability of juvenile salmon and other fish to find prey and can reduce light penetration and photosynthesis in eelgrass and algae. Anchoring the pile-driving vessel could also result in temporary localized disturbance of the bottom where the anchors dig into the sediment.

Some increase in turbidity would be unavoidable. However, the effects would be temporary and would not result in significant impacts because:

- Existing failed pilings would be left in place or cut off at the sediment surface to prevent unnecessary sediment disturbance.

- Currents would disperse turbid water from the site. A study conducted at a similar site 1.9 miles northeast of the dock measured currents of up to 0.8 foot per second (average of 0.48 foot per second) at a 12-foot depth during a 10-hour period with a 6.3-foot exchange (FishPro 1989). Similar currents would be expected in the vicinity of the dock that would prevent the persistence of turbidity at the site.

- Dock repairs would be completed in about 2 to 4 weeks, which is not long enough to alter the survival rate of eelgrass and algae in the area.

- Sediment disturbance and resultant turbidity would be intermittent and only during pile driving and partial pulling. Piles requiring "fresh heading" would be pulled up a few feet, not all the way out of the sediment.

- Juvenile salmon typically move along the shore while feeding and would be able to avoid temporarily turbid water.

- Sediment disturbance would not be great enough to bury eelgrass or algae.

6.3.8.2 Alternatives 1 and 2

The potential for temporarily increased turbidity would be the same as under the Proposed Action, since the same dock repairs would be required.

6.3.8.3 No-Action

Under the No-Action Alternative, no dock repairs would be required and there would be no temporary increase in turbidity.

6.4 Mitigation Measures

6.4.1 Measures Already Proposed by the Applicant or Required by Regulation

- Dock repairs would follow the requirements for new dock construction, as outlined in Table 6-2.

- To protect against sand and gravel spilling from the conveyor belt into the intertidal and subtidal marine environment, a spill tray would be fitted below the conveyor belt from the beach out to the discharge end. The tray would be checked and maintained on a regular schedule.

- The conveyor belt would be equipped with an automatic power interrupt switch, which engages if no barge is in place to accept the material.

- All tugs and other potential sources of petroleum product spills would be equipped with emergency spill response and clean-up equipment.

- A spill response and containment plan for site mining activity would be prepared.

- For this assessment, eelgrass and bull kelp were assumed to be present anywhere down to -22 feet MLLW. To define the specific areas where these species occur, additional surveys will be conducted between June 1 and October 1.

- Prior to construction, a marine monitoring and mitigation plan would be prepared and a monitoring program initiated. The plan would establish a baseline of eelgrass coverage and density, document that the project results in no loss of eelgrass, document that the project results in no significant deposition of sediment in the conveyor/dock vicinity, and provide contingency plans if it appears that the project does result in sediment deposition or a measurable loss of eelgrass coverage or density. The plan would be prepared by a third-party consultant (under contract to King County) and approved by King County and DNR prior to permit approval.

6.4.2 Additional Measures for Consideration to Further Reduce Impacts

- To ensure the risks of aggregate spillage remain low, the project should be periodically monitored for evidence of spills.

- The applicant has agreed to pay for restoration of any sand and gravel spills, and this agreement should be placed as a condition of permit approval.

- The Puyallup Tribe will periodically require access to geoduck beds in the vicinity of the loading dock (roughly once per year). Since it will be unsafe to harvest during barge loading, an agreement should be established prior to project initiation that will provide adequate access for Puyallup Tribe geoduck divers. Access for part of the year near the dock that allows 2 percent annual harvest should suffice.

- Recycled pilings should be used for dock repairs and maintenance (new pilings can release creosote).

6.5 Cumulative Impacts

With mitigation, as described above, the project would not contribute to cumulative impacts on the marine environment.

6.6 Significant Unavoidable Adverse Impacts

With the mitigation measures listed above, significant unavoidable adverse impacts on the marine environment are not expected from the Proposed Action or other alternatives.

6.7 Citations

6.7.1 Printed References

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Table 6-1. Summary of Marine Habitat Zones Adjacent to the Project Site

Habitat Zone	*Slope and Depth*	*Substrate*	*Typical Plant and Animal Life*
Shoreline	Elevation greater than about +13.4 feet MLLW	Coarse sand with occasional areas of cobble	Sparse.
Intertidal	Gentle slope -2.9 to +13.4 feet MLLW	Coarse sand with occasional areas of cobble	Various algae, eelgrass at lower end. Presumably used by juvenile salmon, spawning herring, surf smelt, and sand lance.
Nearshore Subtidal	Gentle to steep slope, -2.9 to -22 feet MLLW	Sand and silt	Patches and beds of eelgrass, various algae including Sargassum, flat fish (e.g. sole, flounder), juvenile salmon (including chinook), and herring (spawning).
Offshore Areas	Tidal elevations below -30 feet MLLW	Sand and silt	Bivalve mollusks including geoduck clams, horse clams, cockles dominate. Various starfish species, especially the sunflower-star (Pycnopodia helianthoides).
Dock	Gentle to steep slope, greater than +4 to -22 feet MLLW	On and adjacent to pilings	A typical piling community. Species observed on the pilings included sea anemones, giant barnacles, green sea urchins, kelp crabs, decorator crabs, nudibranchs, limpets, chitons, mussels, jingle shells, and various red and brown algae. Pile perch, striped seaperch, and rockfish also expected here.
Sunken Boats	Below -30 feet MLLW	Pleasure boat and two wooden barges.	Large numbers of pile perch, striped seaperch, lingcod, and rockfish. At least three masses of lingcod eggs were observed on one of the sunken barges.

Table 6-2. Compliance Analysis of Washington Administrative Code Guidelines Related to Dock Construction

WAC Requirement per Chapter 220-110 WAC HYDRAULIC CODE RULES	*Compliance as Proposed?*	*Additional Mitigation Required*
Work waterward of the ordinary high water line shall be prohibited or conditioned for the following times: March 15 – June 14.	No.	Require dock repair work to be completed outside of these dates.
(3) Piers, docks, floats, rafts, ramps, boathouses, houseboats, and associated moorings shall be designed and located to avoid shading of eelgrass (Zostera spp).	Yes. The major portion of the dock (where barges would be loaded) is located in areas too deep for eelgrass.	
(4) Kelp (Order Laminariales) and intertidal wetland vascular plants (except noxious weeds) adversely impacted due to construction of piers, docks, floats, rafts, ramps, boathouses, and houseboats shall be replaced using proven methodology.	Yes. No kelp or other intertidal wetland vascular plants would be disturbed.	
(5) Mitigation measures for piers, docks, floats, rafts, ramps, and associated moorings shall include, but are not limited to, restrictions on structure width and/or incorporation of materials that allow adequate light penetration (i.e., grating) for structures located landward of -10.0 feet MLLW.	Potentially. Compliance would require additional consultation with the WDFW.	The WDFW may require grating to be used where possible to allow additional light penetration along the shoreline.
(6) Piers, docks, floats, rafts, ramps, boathouses, houseboats, and associated moorings shall be designed and located to avoid adverse impacts to Pacific herring spawning beds and rockfish and lingcod settlement and nursery areas.	Yes. No spawning beds are located where the dock and related construction work would occur.	
(7) Piers, docks, floats, rafts, ramps, boathouses, houseboats, and associated moorings shall be designed and located to avoid adverse impacts to juvenile salmonid migration routes and rearing habitats.	Yes. The elevated pier structure with widely spaced pilings allows fish passage.	

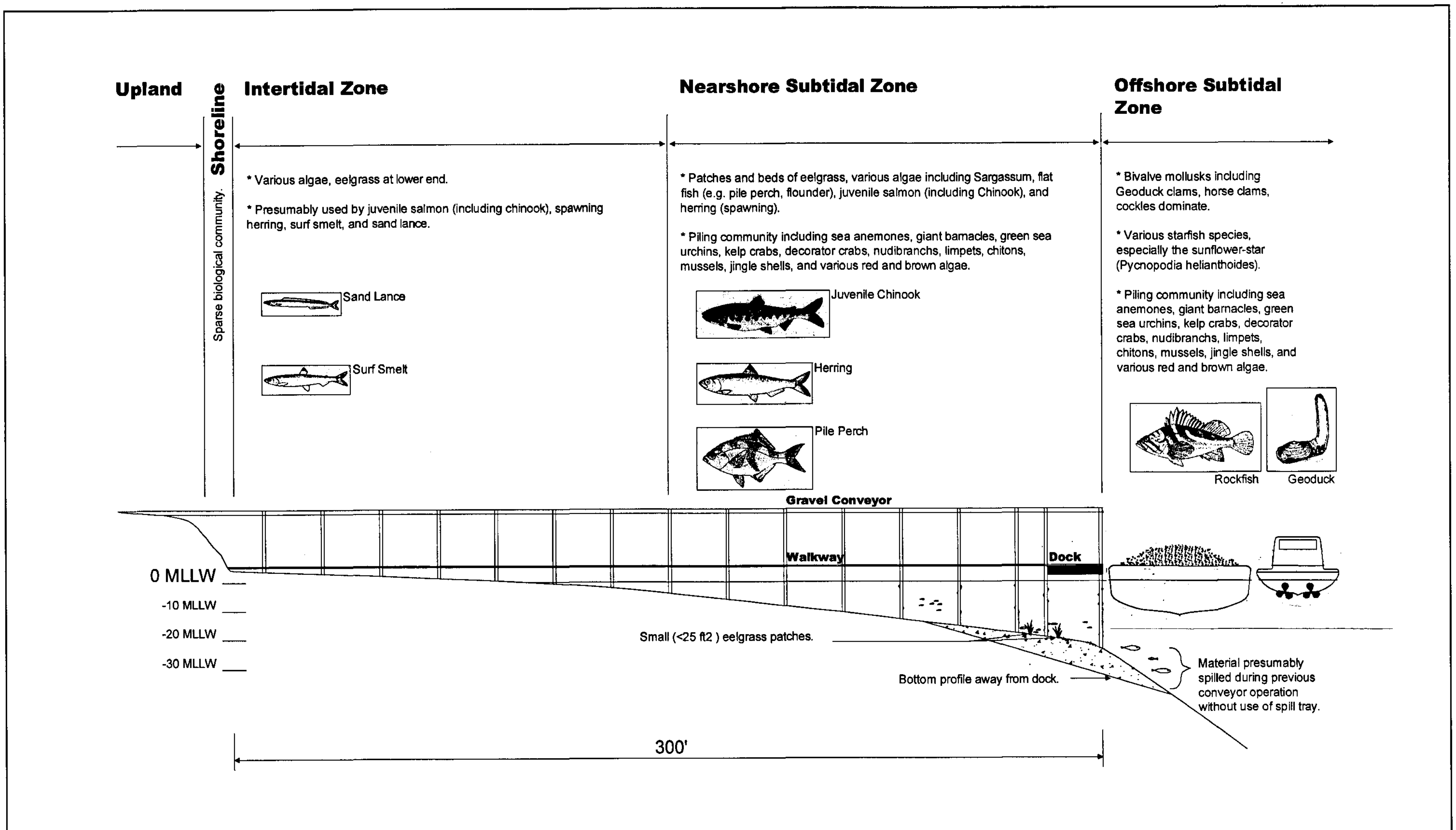

Figure 6-1. Cross Section of Nearshore Area Potentially Affected by Proposal

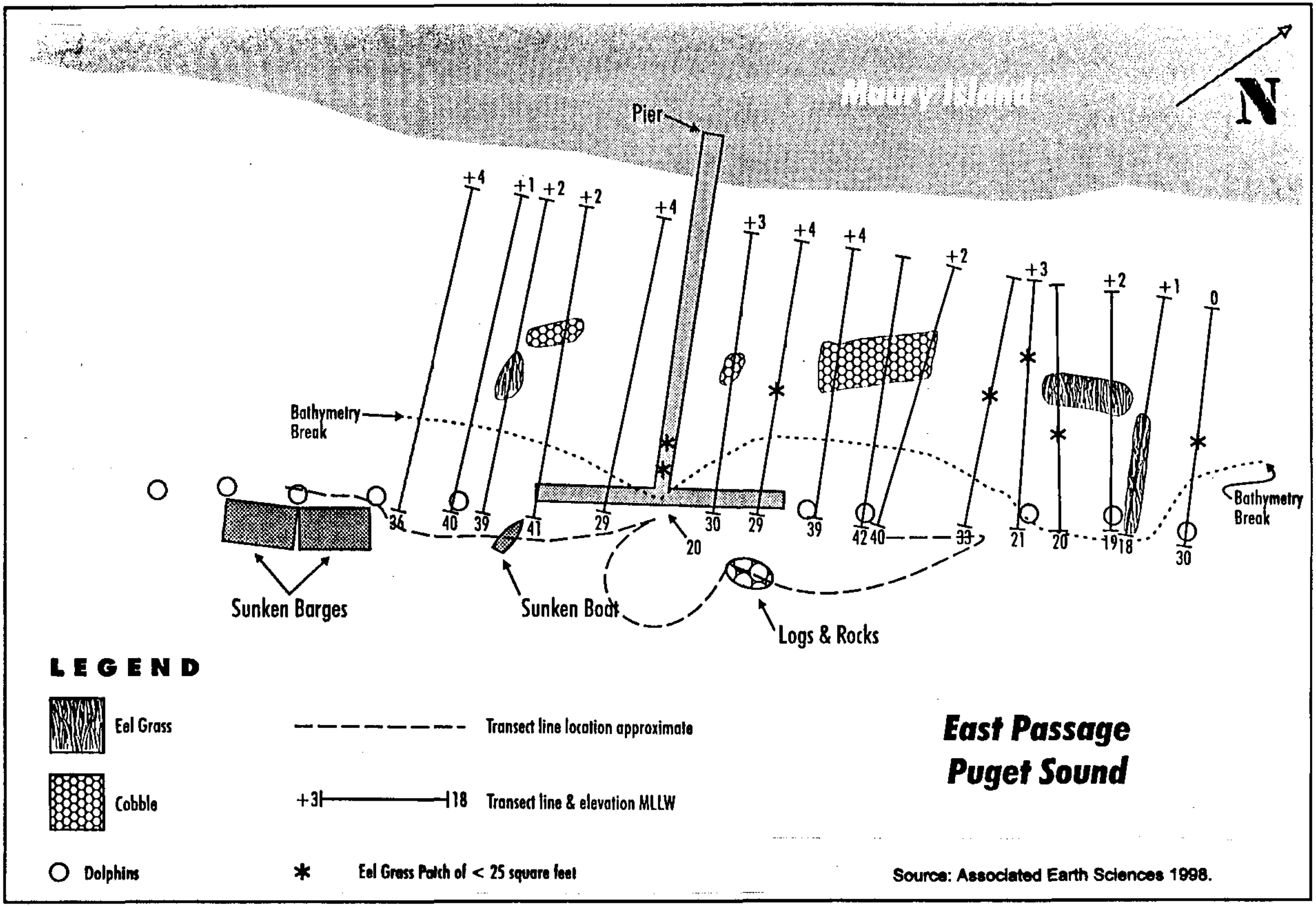

Figure 6-2. Marine Habitat Reconnaissance Survey Map